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ABSTRACT

The intention of a research project was to determine the effectiveness of the Personalized, Individualized, Vocational Occupations Training (PIVOT) materials developed by the School District of Philadelphia in developing entry-level competency in secondary school vocational students. The subject areas selected for the study were industrial electricity, machine shop, and nursing assistant and were taught in skills centers, comprehensive high schools, area vocational-technical schools, and special education occupational schools. Experimental classes using the modular PIVOT materials were taught by means of individual sound-on-slide projectors, while control classes were taught the same subject matter by conventional methods. The rates of success on a criterion task administered by specialists in each field were compared as an indication of the relative effectiveness of the two methods of instruction. The PIVOT method proved capable of developing entry-level competency in each of the areas and settings examined, and the rate of success among the experimental students was not significantly different in any subject area or setting from the rate of success of students taught by conventional methods of instruction. (Appendixes include test instruments used with the criterion tasks, examples of student review and evaluation sheets, and teacher questionnaires and responses.) (Author/YLB)

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FINAL REPORT

Project No. 498AH70196
Grant No. G007702217

PIVOT RESEARCH II

Research Project in Vocational Education
Conducted Under
Part C of Public Law 88-210 as Amended

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
Bureau of Occupational and Adult Education

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AUTHOR'S ABSTRACT

This study was intended primarily to determine the effectiveness of the Personalized, Individualized, Vocational Occupations Training (PIVOT) materials developed by the School District of Philadelphia in developing entry-level competency in secondary school vocational students in a variety of educational settings and subject areas, including Special Education classes. Experimental classes, using the PIVOT materials, were taught by means of individual Sound-on-Slide projectors, while control classes were taught the same subject matter by conventional methods. The rates of success on a criterion task administered by specialists in each field were compared as an indication of the relative effectiveness of the two methods of instruction. The PIVOT method proved capable of developing entry-level competency in each of the areas and settings examined, and the rate of success among the experimental students was not significantly different in any subject area or setting from the rate of success of students taught by conventional methods of instruction, with no loss to the student, in situations where use of an individualized method of instruction is required.

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INTRODUCTION

Between 1972 and 1977, the School District of Philadelphia developed a series of Sound-on-Slide instructional units in various vocational areas for use in what is known as the Personalized, Individualized, Vocational Occupations Training (PIVOT) program. This system of instruction allows the individual student as much time as necessary to complete each instructional unit, which consists of a tray of slides with recorded instructions in the slide holders and various printed materials, including pre- and post-tests on the unit. Each unit teaches the student a single, small task; the intended overall effect of a series of such units is to develop a vocational competency based in a combination of the tasks taught by the various units.

The individual PIVOT units are given to the student at a "work station" equipped with a sound-on-slide projector and the tools and materials needed for the completion of the particular sound-on-slide unit. After the student believes that he is capable of performing the task taught by the unit (he uses the self-evaluation instrument provided with the unit to determine this), the instructor administers a post-test. Only students who pass the post-test are permitted to advance to the next unit of instruction, so that successful completion of a series of units implies that all post-tests in that series have been passed. What is not ascertained within the system itself,

however, is whether or not a student who has successfully completed a series of units can perform a larger task combining the various skills acquired in the completion of a number of separate units logically related to the larger task. The need for this determination under controlled experimental conditions was one of the main motivations for the present study.

The experimental nature of the study mandated the use of certain procedures which were perhaps more rigorous than would be required in ordinary classroom use of the PIVOT system. It was desired, for example, that teachers involve themselves as little as possible in teaching the same subject matter as that presented in the units, in order to determine the effectiveness of the sound-on-slide units alone. The modular design of the PIVOT system makes it highly adaptable to local settings, and instructions are provided for modification of the sound-on-slide units at the level of the individual classroom, if necessary, to make the units maximally effective. In the present study, however, the need for uniformity of experimental conditions precluded modification of the units by individual teachers, although the units to be used in the study were subjected to individual examination by industrial and school district consultants, and some revisions were made before the units were replicated for use in the study. Any incidental mismatching between the equipment shown in the slide units and that found in the experimental shops would,

however, have had a greater effect on the experimental results than in the usual classroom situation, where a teacher would have been able to make revisions in the materials, if resources to do so were available.

The purposes of the present study were (1) to determine whether or not students trained by the PIVOT system demonstrated job entry competency in their area of instruction; (2) to determine whether or not students trained by the PIVOT system demonstrated proficiency equal to or greater than that of students trained by conventional methods; (3) to determine the usefulness of the PIVOT system in the skills centers.

The experiment was carried out with Philadelphia public school students enrolled in state-approved vocational programs in comprehensive high schools; in area vocational-technical schools; and with Educable Mentally Retarded (EMR) students studying a Nursing Assistant curriculum, some in Special Education occupational schools and some in comprehensive high schools.[1]

The experimental design was implemented during the 1978-79 school year. In each setting, classes in the Industrial Electricity, Machine Shop, and Nursing Assistant areas were instructed by the PIVOT method, and other classes were instructed in the same subject matter by conventional methods. At the conclusion of their training, students were given a performance test, constructed and administered by representatives from industry and School District of Philadelphia subject matter specialists, to determine whether or not they could

successfully perform tasks based on the content of the PIVOT materials. The rates of success in the experimental and control classes were compared in each setting and subject area to determine the relative effectiveness of the PIVOT and traditional methods of instruction.

The skills centers are expected to utilize the PIVOT system as their main means of individualized instruction. Thus, an examination of the usefulness of the PIVOT system in the skills centers was considered very desirable, although a controlled experiment was not possible in that setting (since there is no parallel education facility in which the same material is taught by conventional methods). Therefore, this aspect of the study was limited to on-site observations, discussions with skills center teachers and supervisors, and data collection by means of questionnaires completed by skills center teachers. The emphasis on "mainstreaming" of EMR students into regular classes, and the fact that the PIVOT system is apparently well suited to use by poor readers, made its testing with EMR students quite desirable. In the present study, some of these students were in special schools, with only other EMR students, and some were "mainstreamed" students who were studying the Nursing Assistant curriculum in the same classes as regular students.

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[1]Administratively, all state approved vocational courses are considered to be part of the Philadelphia Area Vocational-Technical School, regardless of their location in the city. For the purposes of this experiment, however, it was considered desirable to identify by their former school designation the types of facilities within which these courses were taught. A description of each type of facility will be found in Appendix L.

The present study is based, in part, on a similar study carried out in Philadelphia during the 1975-76 school year. In that study, in which it was desired to sample as broad a cross-section as possible of the vocational education spectrum in the Philadelphia schools, classes were selected in a total of five different subject areas. with one class per setting (i.e., comprehensive high schools, area vocational-tecnnical schools, and Special Education occupational schools) for the experimental method and one for the control method. This emphasis on diversity turned out to be one of the main weaknesses of the study, however, since delays in acquisition of needed projectors and other materials reduced the available teaching time, and very few students per class were available for testing at the end of the year. The only group for which sufficient subjects were available for a valid statistical test was in the Nursing Assistant area, with EMR students attending Special Education occupational schools. For this group, the PIVOT method was shown to be significantly more effective than the control method, but the entire test population consisted of ten experimental and six control students, all from the same school. Although little empirical knowledge resulted from the previous study, much useful experience was obtained which was of help in designing the present study.

The experience of the 1975-76 study was that a great deal of set-up time must be provided before teaching begins.

Therefore, the present study allowed for the use of the spring, 1978 term for preparation of materials and training of participating teachers, with teaching to begin as of September, 1978. The previous study showed that in control classes, where the class was taught as a group, more students were available for testing, since they did not have to use the instructional materials individually, and the teacher was usually able to cover all of the required material by the time testing started. In view of this, and to increase sample sizes for the present experiment, it was decided to select four experimental and three control classes for each setting and method. This, combined with the earlier start possible by training the teachers during the preceding term, was expected to have the effect of increasing sample sizes by at least a factor of four, compared to the previous study.

An additional precaution in the present study was that the PIVOT instructional units selected for use required shop equipment that could reasonably be expected to be found in almost any shop teaching that subject, thereby minimizing the degree of mismatching of equipment pictured in the slide units with that found in the shops. Provision was also made for the examination of the Sound-on-Slide units by the industrial and school district consultants before they were replicated, so that minor revisions or corrections could be made before the units were distributed to the participating teachers.

PROCEDURES

The basic design of this study involved teaching the same vocational subject matter to different groups of students by two different methods (i.e., the PIVOT method and the traditional method of teaching the same material) and then comparing the rates of success on a criterion task administered to all of the students at the completion of their training. In order to do this, it was necessary to locate suitable classes and teachers and to train the teachers in the use of the PIVOT method (or else to inform them of what they were to teach by the conventional method). Consultants were needed to aid in the construction of the criterion tasks and to administer the tasks to the students. Procedures for the actual testing of the students had to be developed. This section details the various procedures followed during the course of the experiment.

Site and Staff Selection

The first activity to which the project manager and research assistant addressed themselves was the selection of the schools involved in the study. It was necessary to have shop classes in each of the subject areas, in both the comprehensive high schools and the area vocational-technical schools, and, in the case of the Nursing Assistant area, in occupational schools. The subject areas included in the study were Industrial Electricity, Machine Shop, and Nursing Assistant, the last specifically with EMR students. Both skills centers operating in Philadelphia at the time of study were included in the examination of the usefulness of the PIVOT method in a skills center. One of these Skills centers had opened and had been using the PIVOT materials for several years before the second one opened, and it was thought that

some observations might therefore be possible of the differerces in PIVOT utilization in its early and later stages.

In some cases, it was possible to locate both the experimental and control classes in the same subject in the same schools, and then to have them taught by the same teacher, with different classes. While this was not possible in all cases, it was thought to be a desirable way of reducing differences between the experimental and control groups, and between their teachers, where the school organization and the wishes of the participating teachers permitted it.

The schools to be used in the study were selected in the following manner: (1) a pool of schools was identified which taught courses in the required subject areas that were approved by the Bureau of Vocational Education, Pennsylvania Department of Education; (2) schools with suitable courses were randomly assigned to the experimental and control methods of instruction, with separate selections being made for the comprehensive high schools and the area vocational-technical schools (AVTS). Since there were only three AVTS's in the entire school district that offered subjects included in this experiment, meeting the stated quota of four experimental and three control classes per area was not possible in the AVTS's, but all available classes were utilized either in experimental or control groups.

Once suitable schools were located, teachers of the courses were identified by consulting the principals and department heads in the schools. Only teachers who expressed a willingness to participate in the experiment were selected. The only deviation from this random process took place in the case of teachers who had already had classroom experience in the use of the PIVOT method (some from having participated in the 1975-76 study). Since the control teachers would be using their own teaching methods, in the familiar setting of their own shops, it was considered desirable to allow teachers who had had previous experience with the PIVOT method to use that method, to help offset the experience of the control teachers.

It was also necessary to match the level of instruction of the students in the experimental and control classes. That is, all of the Machine Shop students, for example, were first year students in that course, as were the students in the other two areas, so that they had not previously been instructed in the material taught in the experiment. After all of these factors had been taken into consideration, there were four experimental Nursing Assistant classes and three control classes, four experimental and four control classes in Machine Shop in comprehensive high schools, three experimental and two control classes in Machine Shop in AVTS, three experimental and three control classes in Industrial

Electricity in comprehensive high schools, and two experimental and two control classes in Industrial Elecricity in AVTS. Altogether 30 classes were selected to participate in the experiment, 16 experimental classes and 14 control classes.

Staff Development Activities

Following selection of teachers at the participating schools, during the spring, 1978 term, a series of staff development meetings took place at the John F. Kennedy Center.

The first of these, on May 11, 1978, was for the purpose of acquainting all of the teachers with the general nature of the experiment, the roles of the experimental and control teachers, and the content of the Sound-on-Slide units to be used by the experimental teachers. This was particularly important for the control teachers, who were expected to teach the same subject matter as that covered in the units used by the experimental teachers, and who thereby had the opportunity to examine the individual units that the experimental teachers would be using.

On May 25, 1978, a meeting was held for teachers of the experimental classes, for the purpose of discussing the use and maintenance of the Sound-on-Slide projectors, procedures for setting up work stations in their shops, and the record-

keeping requirements for the experimental students. A supervisor from one of the skills centers who had had extensive experience in the use of the PIVOT system discussed these matters with the group, and also showed a Sound-on-Slide program concerning the use of the PIVOT system.

One June 1, 1978, the control teachers received further information about their role in the experiment, and provided project personnel with background information about their anticipated classes (for the fall semester, when the actual experiment would take place). They were also given the opportunity to review the material that they were expected to cover in class, so that they would be able to plan their teaching schedule for the following year.

A meeting was held for all teachers on October 26, 1978, after the experimental teachers had received their Sound-on-Slide projectors and had begun setting up their work stations. At that meeting, teachers were reminded of the things covered during the spring meetings, and had the opportunity to discuss any problems they were having in setting up their shops for the experiment. Testing procedures were discussed, so that the teachers would be aware of the type of activities in which their students would be expected to demonstrate competence.

On January 11, 1979, all teachers were invited to a meeting at which final arrangements for testing were detailed. Specific procedures to be followed during testing were

discussed, and teachers were given the opportunity to make suggestions or ask about problems that they anticipated. Also, administrative information such as class size was collected, to help in the development of final testing schedules.

It should be noted that contacts with the experimental and control group teachers took place on many occasions other than the staff development meetings, and much individual consultation took place, to help the teachers carry out their respective roles in the project. Such individual consultation is probably essential to the implementation of this sort of experiment.

Selection of the Consultants

The same industrial and school district consultants who had participated in the 1975-76 research study were still available and willing to participate in the present study, in the same subject areas. Each of the three subject areas in the present study was represented in the previous one, so that no new consultants were needed. Since each of the previous consultants had already had experience in reviewing slide units, constructing criterion tasks, administering these tests to students, and had seen the PIVOT system in use in classrooms, during their participation in the previous study, their availability for the present study made the selection of any other consultants unnecessary.

It is worth explaining, however, the method by which the consultants were selected for the 1975-76 study. At that time, it was desired to find one consultant in each subject area from private industry and one from the School District of Philadelphia's administrative staff, each with industrial and/or educational expertise in a specific area. To locate the industrial consultants, project personnel contacted the Coordinator of the Advisory Council for Career Education for the School District of Philadelphia, who was able to secure the cooperation of various industrial companies, so that they would allow their personnel to participate in the experiment. The Career Education Division of the School District of Philadelphia located school district personnel who could serve as consultants for the project. The recommended individuals were then contacted by project personnel, who explained the activities in which they would be asked to participate.

Selection and Examination of Units to be Taught

A list of Sound-on-Slide units believed to be suitable for the experiment was presented in the proposal for this project. Those units, in the areas of Nursing Assistant, Electrical Construction, and Machine Shop, were selected by the proposal writer and the research assistant, according to the following criteria:

(1) The units covered the first, and most common instructional topics in each area;

(2) The units utilized equipment and supplies common to most shop locations within the School District of Philadelphia, and were not dependent upon specialized equipment or materials;

(3) The "master units" (from which copies would be made for use in the experimental classrooms) were all previewed, and were, in the opinion of the proposal writer and the research assistant, complete and of good quality, although they were later submitted to the consultants for further examination.

A list of the Sound-on-Slide units selected at the time the proposal was written is given in Appendix A.

During the spring, 1978 term, the industrial and school district consultants individually examined each of the units included in the original list. In addition to discussing the suitability of the units for the purposes of the experiment (in terms of topics covered), the consultants rated each unit and each slide within each unit according to a checklist and set of definitions of possible deficiencies (See Appendix B). These deficiencies included such things as use of unsafe procedures, poor slide quality, poor sound quality, and overall deficiencies in the organization of the unit.

Since students were to be given a performance test at the end of their training, and since this test was to involve a combination of as many tasks as possible from

individual Sound-on-Slide units, it was also important that the series of slide units used in the experiment be logically related, so that a criterion task could be developed that would fairly represent a large proportion of the operations shown in the individual units. It was also desired that a student could reasonably be expected to complete the entire series of units in approximately ten weeks; this would allow time for most or all of the students in an experimental class to complete all of the units.

Based on the examination by the consultants, and in accordance with their advice, revisions were made in the list of units to be used in each area. In the Nursing Assistant area, eight units were recommended for use in the experiment, five of which came from the original list, and three others which the consultants felt were more suitable for EMR students than the ones originally suggested. In addition, the units were arranged in a more logical order and renumbered according to the new sequence. In the Electrical Construction area, the list of units was reduced from 20 to 18 by omitting two units that the consultants felt were not logically related to the other units. The list of Machine Shop units was shortened from 31 to 20 units,

with the assurance of the consultants that this would be an adequate sample of the students' abilities, since some of the same operations learned in the first 20 units were used in the last 11. In addition, reducing the number to 20 units helped to insure that adequate numbers of students would be able to finish the entire sequence of units in time to be tested. The units finally selected for use in each subject area are listed in Appendix C.

Revisions were also made in the content or technical quality of some units, based on the consultants' suggestions for improvements or corrections. In some cases, these involved nothing more than re-recording sound tracks which were indistinct, or in which the consultants felt the script could be improved. In other cases, particularly in the Nursing Assistant area, the consultants recommended the use of new photographs and scripts which they felt would better suit the units to the needs of EMR students. Arrangements were made to take such photographs in actual Nursing Assistant classes within the school district, and these new slides were incorporated into the units. By the end of the spring, 1978 term, all recommended revisions had been made, and the units were replicated in sufficient quantity to that each

experimental group teacher would have a complete set of slide units for the class, consisting of one copy of each of the listed units.

Development of the Criterion Tasks

The criterion tasks (i.e., the tests that the students would be given at the end of the experiment) consisted of various operations that the consultants judged a student should be able to perform after having successfully completed the appropriate slide units. Each task was a combination of smaller jobs taught in the individual slide units. Upon completion of the task, the student was graded "Pass" or "Fail" by the consultants, who were present at the testing sessions. The criterion for passing was whether or not the student had displayed "entry-level competency" in the task. The only limitations placed on the task the consultants designed were that it should be reasonably brief (twenty minutes or less) to allow testing an entire class in one day, one at a time, and that it be based entirely on the content of the slide units in that subject area.

In each of the subject areas, the consultants reviewed the revised units verifying that the content and technical quality were suitable for the purposes of the experiment. They then suggested a criterion task for each area, and a checklist to be used for their own guidance as they watched

the students carry out the criterion task. These initial tasks and checklists were then field-tested in schools not involved in the experiment, in order to refine them, and to give the consultants and the experimenters practice in conducting the testing. As finally refined, the tests were able to be administered in less than twenty minutes per student, and were considered by the consultants to be suitable for the purposes of this experiment. Copies of these instruments are presented in Appendix D.

Classroom Implementation

Classroom implementation of the experiment required that teachers of the experimental classes be provided with Sound-on-Slide projectors and a set of slide units for the topics their students were expected to study. Student Review and Evaluation Sheets, which incorporated a checklist for use by both the student and the instructor, and a description of the individual task to be studied in a slide unit, were reproduced in sufficient quantity so that each student in the experimental classes would have one for each slide unit in the subject area. Samples of these sheets are presented in Appendix E. Student Review and Evaluation Sheets were available for the Electrical Construction and Machine Shop areas, but not for the Nursing Assistant units. During discussions at the staff development meetings, however, it became clear that the Nursing Assistant teachers felt that

the lack of these printed sheets would not be a negative factor for the EMR students, who were very poor in reading. Therefore, no effort was made to provide such sheets for the Nursing Assistant students.

By October, 1978, all of the experimental class teachers had received their slide units, projectors, and printed materials, and were setting up work stations in their shops. The number of such work stations depended upon the space available and the facilities in each shop. In cases where only one drill press was present in the shop, for example, only one student at a time could use units that involved operating the drill press. However, other operations (such as layout work) shown in separate units which were part of the same task could be learned by students in other parts of the room, using another projector, so that even in shops with only one suitable machine, more than one student could be using the units at a time.

The control teachers were to use their usual method of teaching the subject matter found in the slide units, and had been given a copy of the Student Review and Evaluation Sheets, so that they would be aware of exactly what was being taught to the experimental classes. In addition, each teacher of a control class was shown the slide units that would be used in the experimental classes. The control teachers expressed the

opinion that they would be able to teach the material covered in the slide units and did not anticipate any difficulties in teaching the required material in the available time.

Administration of the Final Tests

To provide for systematic and orderly administration of the final tests to the experimental and control classes, and to give the teachers a definite deadline by which they were expected to have completed instruction in the required material, a testing schedule was distributed to all participating teachers at the end of October, 1978 (see Appendix F). Tests in each subject area were grouped together, both for the convenience of the consultants, who had to make arrangements to appear at the test site, and also to minimize communication between teachers about the content of the tests. All tests were administered during the regular school day in the students' own shop, using the same equipment they had used in learning the tasks.

Because of the time required to test the students one at a time, arrangements were made in advance in each school to have students who could not be tested during the regular shop periods report during other periods when their teacher could be present in the shop. For reasons of uniformity and class control, it was considered advisable to use the shops only

during periods when the regular teacher was present, although the teachers were not involved in the actual administration of the tests. From the standpoint of test validity, it was considered unwise to return to a school for a second day of testing, since the students in a given shop could hardly be expected not to communicate the content of the test to those not tested on the first day. Therefore, in any shop, testing was limited to as many students as could be tested in one day, and students' names were arranged in advance in random order, so that those omitted because of lack of time would be randomly selected.

The consultants and project personnel administered the final tests to all of the students between January 18 and June 14, 1979. At each testing session, a work station suitable for the task to be performed was set up in an area of the shop not visible to the students not yet tested. After testing, students were sent to another classroom, so that they would not communicate with students who had not yet been tested. In some cases, the reverse procedure was followed: students who had not been tested were kept in another room and those who had been tested remained in the shop after the test. In all cases, however, no significant communication occurred between those who had been tested and those who had not.

at all. These students were so slow that it was only possible to test five of them during the day, and none of those five successfully accomplished the task. The type of work they produced made it seem to the consultants that the students could not possible have been given an adequate opportunity to learn the required material. In addition, when the teacher was consulted, he told the consultants that he had directed the students to disregard instructions in the sound track, and to use his method of doing the task, instead. There were three other experimental Machine Shop classes in comprehensive high schools, and since the test results in this one class were quite atypical of the results which the consultants had already seen in other experimental Machine Shop classes, they recommended that the data from this class be dropped from the study. In accordance with this suggestion, only the test results from the other three experimental Machine Shop classes in comprehensive high schools have been included in the experimental data.

Questionnaires

One technique used to obtain information about the usefulness of the PIVOT system in the two Philadelphia skills centers that were operating at the time of the experiment was to distribute a questionnaire (see Appendix G) eliciting information about the uses to which the teachers had put the Sound-on-Slide units, their opinions of the units; effectiveness in teaching the subject matter in their area, and their feelings about using the system with their classes. There was also provision for noting problems they might have had in implementing the system in their shops, and for any comments they might care to make concerning matters not covered by the

questions. The questionnaires were distributed to the teachers at each skills center by the principal of the school, and returned to the principal, who then forwarded them to the research assistant.

An area in which a great deal of information was potentially available was an investigation of the reactions and problems of teachers implementing the PIVOT system in regular classrooms where it had never before been used. The perceptions of such new users of the system were expected to be of considerable interest to those planning to implement the PIVOT system in the future. Accordingly, a questionnaire was distributed to all teachers of experimental classes, after they had completed their use of the PIVOT materials. This questionnaire will be found in Appendix H.

Data Analysis

The nature of the data derived from the final tests (Pass/Fail) and the two treatment categories (Experimental/Control) indicated that the use of a non-parametric test (the Chi-square test) would be most appropriate for analysis of the data from this experiment.[2] In some cases, the number of subjects in particular sub-groups did not meet the criteria

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[2]Siegel, Sidney. Nonparametric Statistics for the Behavioral Sciences. New York: McGraw-Hill, 1956. pp. 104-110.

for the use of the Chi-square test,[3] and the Fisher Exact Probability Test[4] was used instead. Reading scores from the California Achievement Test (Reading) for the experimental and control groups in each setting were compared by a *t*-test of uncorrelated means, to determine whether or not there were significant differences between the mean reading scores of the experimental and control subjects.

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[3] *Ibid.*, p. 110.

[4] *Ibid.*, pp. 96-104.

RESULTS

This study was conducted for the purpose of achieving five objectives. In this section, each objective is stated, followed by a summary of the methods used to achieve it and the experimental data relevant to that objective.

Objective 1

> To determine whether, after having successfully completed approximately ten weeks of instruction by the PIVOT method in one of the following courses:
>
> (a) Nurse's Aide
> (b) Industrial Electricity
> (c) Machine Tool Trades
>
> students will be able to demonstrate job entry competency in an assigned trade task according to prevailing industry standards, as judged by knowledgeable personnel from industry and from the Trade and Industrial Education staff of the Division of Career Education of the School District of Philadelphia.

To collect the information needed to accomplish this objective, students in each of the experimental settings (comprehensive high schools, area vocational-technical schools, and Special Education occupational schools) were instructed in a series of tasks by the use of the PIVOT Sound-on-Slide system. Students who completed the entire series of slide units in their area were then asked to perform a criterion task which was a combination of operations found in various slide units, which the industrial and school district consultants agreed a student

who had learned the material in the slide units should be able to perform. The grading of the tests (Pass/Fail) was based entirely upon the performance of the student, as observed by the consultants, and the tests were constructed with the intention that successful accomplishment of the criterion task could be considered an indication of entry-level competency in that task.

Table 1 indicates the subject areas and types of school in which the PIVOT system was implemented, the number of students who completed instruction in the assigned units, and the number passing and failing on the criterion task.

Table 1

Numbers of Students Instructed by the PIVOT Method Passed and Failed on the Criterion Task in Each Setting

Subject Area	Type of School	Number of Experimental Students (PIVOT Method)	Number Passed	Number Failed
Machine Shop	Comprehensive High Schools	23	17	6
Machine Shop	Area Vocational-Technical Schools (AVTS)	22	14	8
Industrial Electricity	Comprehensive High Schools	23	11	12
Industrial Electricity	AVTS	24	12	12
Nursing Assistant (EMR only)	Occupational Schools and Comprehensive High Schools	22	10	12

It should be noted that completion of an entire series of slide units, to qualify for the final test, required that the student successfully pass the post-test, administered by his instructor, at the time he completed each unit, before going on to the next unit. Thus, all students eligible for the final test had at one time mastered the contents of the slide units, and what was being tested here was whether or not they could retain and apply this learning to the completion of a larger task which combined skills from various individual units. It can be seen in Table 1 that a substantial proportion of each experimental group was able to successfully perform the criterion task.

Objective 2

> To determine whether students will be able to demonstrate proficiency equal to or greater than comparable students in a variety of educational settings (i.e., comprehensive high schools, area vocational-technical schools, occupational training centers for EMR secondary students) after having completed training in the same skills under different educational methodology (i.e., PIVOT as opposed to traditional classfront instruction).

To compare the effectiveness of the PIVOT method of instruction to the effectiveness of traditional methods of teaching the same material, it was necessary to have control classes which were taught the same subject matter

as that presented in the slide units, but by the usual, classfront methods. Accordingly, control classes were tested during the same time periods as the experimental classes in the same subjects (see Appendix F). In the case of students in control classes, it was decided to test all students who had been present at the time the subject matter for the experiment was taught to the class, excluding only those with extensive records of absence, who would not have had a chance to learn the skills needed for the test. As it happened, virtually all students who had been absent extensively during the year were also absent when the tests were given, so that it was not necessary to grant such exceptions in most classes. The main limitation on the number of students tested, where any had to be excluded, was the amount of time available for testing (students were tested in random order, as explained previously).

A factor which might influence a student's ability to profit from the experimental or control method of instruction was reading ability, and it was considered desirable to examine the reading scores of the students in the experimental and control groups, to see if any significant differences existed between the mean scores in these groups. Student scores on the California Achievement Test (Reading) were

available from the school district's central records, based on an administration of the test in February, 1979. Students are graded in two different ways on this test. One score, known as the Achievement Development Scale Score (ADSS) can be used to calculate a mean reading score for the experimental and control groups in each setting (except for the EMR students, who do not usually take this test). Each student also receives a national percentile rank, based on his ADSS score. These percentile ranks were used to assign students to "high" and "low" reading score groups, as will be explained below.

The mean ADSS score was calculated separately for each of the experimental and control groups in the study, with the exception of the EMR Nursing Assistant students. These means were then compared by a *t*-test for uncorrelated means. Table 2 shows the mean ADSS scores for the various experimental and control groups, and the corresponding values of *t*.

TABLE 2

Mean Reading (ADSS) Scores on the California Achievement Test (Reading) for the Experimental and Control Group

Group	N	Mean ADSS Score	t
Machine Shop, Comprehensive H.S. Experimental	23	495.43	0.422, 49 d.f.*
Control	28	506.14	
Machine Shop, AVTS Experimental	22	525.86	0.260, 35 d.f.*
Control	15	532.20	
Industrial Elec., Comprehensive H.S. Experimental	23	535.04	0.603, 48 d.f.*
Control	27	549.67	
Industrial Elec., AVTS Experimental	24	559.58	1.205, 41 d.f.*
Control	19	585.16	

*not significant

The differences between ADSS scores of the experimental and control groups were not significant, and the groups were therefore considered to be equally competent in reading. The numbers of students who passed and failed the final test in the various experimental and control groups were then arranged in 2 x 2 tables, and Chi-square tests were done to determine whether the observed frequencies differed significantly from what would be expected on the basis of chance alone. In all statistical tests for this project, the 5% level of significance was used.

In some cases, the data did not meet the requirements for the use of a Chi-square test,[1] and the Fisher Exact Probability Test, as described by Siegel,[2] was used instead. Table 3 presents the numbers of students passing and failing the criterion task in each experimental and control group, and the associated valued of Chi-square. When the Fisher Exact Probability Test was used, the minimum probability (p) of the observed distribution's occurring by chance is given.

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[1] Siegel, Sidney. Nonparametric Statistics for the Behavioral Sciences. New York: McGraw-Hill, 1956. pp. 104-110.

[2] Ibid., pp. 96-104.

Table 3

Comparison of the Performance on the Criterion Task of All Experimental and Control Subjects

Subject Area and Treatment Group	Number Passed	Number Failed	Chi-square or p (see text)
Machine Shop, Comprehensive H.S.			
Experimental	17	6	Chi-square = 0.19 (1 d.f.)*
Control	18	10	
Machine Shop, AVTS			
Experimental	14	8	p 0.096*
Control	13	2	
Industrial Elec., Comprehensive H.S.			
Experimental	11	12	Chi-square = 0.07 (1 d.f.)*
Control			
Industrial Elec., AVTS			
Experimental	12	12	Chi-square = 0.31 (1 d.f.)*
Control	12	7	
Nursing Assistant EMR			
Experimental	10	12	Chi-square = 0.01 (1 d.f.)*
Control	14	15	

*not significant

As can be seen from Table 3, there was no significant difference between the numbers of students passing and failing the criterion task in the experimental and control groups, in any setting. Thus, it can be stated that students in all groups taught by the PIVOT method demonstrated proficiency not significantly different from that demonstrated by comparable students taught by the conventional method.

The PIVOT Sound-on-Slide method depends on the use of recorded sound tracks which explain to the student the procedures that he is to follow to carry out the task at hand. Therefore, it would appear to be a method well adapted to use by poor readers, and it was considered desirable to examine the possibility that the Sound-on-Slide method, although not significantly different in effectiveness from the control method for the entire experimental and control groups, might have been more effective than the control method with those students lowest in reading ability. To examine this possibility, each experimental and control group listed in Table 3 except for the EMR Nursing Assistant students was divided into two sub-groups, (1) those at or above the 16th percentile in national percentile rank on the California Achievement Test (Reading) and (2) those below the 16th percentile.

The 16th percentile was chosen because it represents performance at a level one standard deviation below the mean of the population, and can be taken to indicate that a student reading below that level is substantially. disadvantaged in reading ability.

When the groups were divided as explained, there were sufficient students in seven of the eight resulting sub-groups to allow the use of either the Chi-square or Fisher Exact Probability Test of the significance of the resulting frequencies of passing and failing. It was not possible to do a statistical test on the data for students below the 16th percentile in reading in Industrial Electricity classes in AVTS, because only two students in that setting were below the 16th percentile in reading, and both of them were in the experimental group. In the other seven sub-groups, however, the statistical tests showed no significant difference between the rate of success of students in the experimental and control groups, just as had been the case for the entire groups. Therefore, it can be stated that no significant difference in effectiveness of the two methods was found in any setting either for students above or below the 16th percentile in reading ability.

Although no significant differences in effectiveness were found between the experimental and control methods in

any of the sub-groups above or below the 16th percentile in reading, it was possible that within a particular method of instruction (for example, all students using the PIVOT method in comprehensive high schools) those students above or below the 16th percentile in reading ability might have learned more effectively.

To investigate this possibility, the data were regrouped by method of instruction, rather than by setting, so that eight new sub-groups were formed:

(1) Experimental Students in Machine Shop classes in Comprehensive High Schools

(2) Control Students in Machine Shop classes in Comprehensive High Schools

(3) Experimental Students in Industrial Electricity classes in Comprehensive High Schools

(4) Control Students in Industrial Electricity Classes in Comprehensive High Schools

(5) Experimental Students in Machine Shop Classes in AVTS

(6) Control Students in Machine Shop Classes in AVTS

(7) Experimental Students in Industrial Electricity Classes in AVTS

(8) Control Students in Industrial Electricity Classes in AVTS

For each of these groups, the rate of passing and failing was compared for students below the 16th percentile in reading to that of students at or above the 16th percentile in reading, in 2 x 2 contingency tables. For the eighth group, this test was not possible, because, as noted

above, there were no control students below the 16th percentile in reading the AVTS Industrial Electricity classes. The observed differences in rates of passing and failing on the criterion task were then tested for significance by either the CHI-square or the Fisher Exact Probability Test, and were all found not significant.

Objective 3

> To determine whether students are able to develop proficiency in job skills using the PIVOT system.

In order to qualify for the final testing, students in the experimental classes were expected to have completed all Sound-on-Slide units in their area. Since at the end of each unit each student was given a post-test by his instructor, before being allowed to progress to the next unit (students who failed the post-test were instructed to repeat the unit until they could pass the post-test), all students who were involved in the final testing would have at some point in the course of instruction mastered the job skills in each PIVOT unit, whether or not they passed the final test. Thus, all of the students listed in Table 1 had developed proficiency in job skills, at least to the point that they were able to progress through the entire sequence of Sound-on-Slide units.

From the standpoint of practicality, however, it was considered wise to examine the reactions and opinions of the teachers who had managed the instruction of the students as they used the PIVOT materials. For this reason, a questionnaire was completed by all of the experimental group teachers during June, 1979, after they had finished using the PIVOT materials with their classes. The responses of the Machine Shop and Industrial Electricity teachers are reported in this section. Those of the Nursing Assistant teachers are reported separately, under Objective 4. The questionnaire completed by the experimental group teachers is presented in Appendix H. A summary of the responses of the Machine Shop and Industrial Electricity teachers is given in Appendix I.

Examination of the questionnaire responses indicated that:

(1) Eleven of the twelve respondents thought the Sound-on-Slide units were "very effective" or "effective" in teaching the material they covered, that their students were generally able to understand the material, and that the students were willing to use the units without constant supervision and monitoring.

(2) Nine reported no difficulties in implementing the Sound-on-Slide units in class (the others referred mainly to problems in setting up work stations and in "cross-talk" while machines were in use -- these problems were not of a serious mature).

(3) Eleven felt that the use of the Sound-on-Slide units was "very beneficial" or "somewhat beneficial" to their students, and that classroom management problems were either not changed or made easier by introduction of the PIVOT method of instruction. Eleven of the twelve also said that their students were "very enthusiastic" or "enthusiastic" about using the Sound-on-Slide method in class.

(4) All teachers chose either "almost always" or "usually" in response to the question "Do the techniques shown in the Sound-on-Slide units agree with what you would consider a proper way to do the jobs shown?"

(5) Six teachers chose "always" and six chose "very often" in response to the question "Are your students able to successfully complete the units that they are given?"

In their additional written comments, several teachers noted the importance of having equipment in the shop that matched that shown in the slide units, so as not to confuse the student. There was a generally enthusiastic feeling among the experimental group teachers who added written comments to their questionnaires, and one teacher of Industrial Electricity wrote a separate letter to the project staff expressing his satisfaction with the PIVOT system, noting especially its motivational value with his students.

Objective 4

To determine whether Educable Mentally Retarded (EMR) students are able to develop proficiency in job skills using the PIVOT system.

As with Objective 3, which referred to the Machine Shop and Industrial Electricity students, it can be stated that all of the EMR Nursing Assistant students listed in Table 1 had developed sufficient proficiency in job skills during their use of the Sound-on-Slide materials to progress through the entire sequence of slide units, passing the post-test at the end of each unit. Thus, regardless of whether or not the EMR students were able successfully to perform the criterion task administered at the conclusion of their training, their instructors had given them passing grades on the post-tests at the time they had completed the individual units, and in that sense they could be said to have developed proficiency in job skills by the use of the PIVOT system.

The teachers of the EMR Nursing Assistant students who had used the PIVOT system completed the same questionnaire given to the teachers of the experimental classes in Machine Shop and Industrial Electricity. Examination of the responses of the four EMR teachers showed that their opinions of the PIVOT method were very similar to those of the other teachers. (See Appendix J for a summary of the responses of the EMR Nursing Assistant teachers.) The only comment written on the questionnaires was by one teacher who noted that her students tended

to look at the slides "over and over again," and were rarely able "to do the procedures through the first time." She also noted that they were easily distracted. Her responses to the multiple-choice items, however, were that the slide units were "very useful," that her students were "very often" able to complete the units they were given, and that they were generally able to understand the material in the units. Therefore, it is reasonable to assume that her comments referred more to the nature of the learning process with EMR students in general than to deficiencies in the slide units.

Objective 5

> To determine the usefulness of the PIVOT system in the two skills centers, for the development of proficiency in job skills.

The main source of data for this objective was a questionnaire completed by the faculties of both skills centers during June, 1979. (A copy of the questionnaire is presented in Appendix G.) As noted under Procedures, these questionnaires were distributed to the teachers by the principals at each facility, collected by them, and returned by the principals to the research assistant. This procedure resulted in a very high rate of return; the only known missing questionnaires were for two teachers who had been absent for an extended period of time, one at each facility. Teachers who had no Sound-on-Slide units were asked to return their questionnaires and so indicate on the questionnaire. This provided a tally of

the extent of availability of Sound-on-Slide units in each facility, in addition to ascertaining the opinions of the faculty members who has used them.

The two Philadelphia skills centers in operation at the time of this study had both opened rather recently. Skills Center A had opened in September, 1975, and Skills Center B in September, 1977. PIVOT Sound-on-Slide units had been on hand when Skills Center A opened, while implementation of the PIVOT system at Skills Center B had started in September, 1978. Thus, one of the skills centers had had PIVOT units available, at least in some areas, for four years at the time the faculty completed the questionnaire for this study, while in the other skills center the units had only been available since the beginning of the same school year. In order not to obscure meaningful information, the returns from the two facilities were treated separately in this report, which also permitted an examination of any differences between the opinions of teachers in a facility where the units had been in use for several years, compared to a facility where they had been newly introduced.

Questionnaires were completed by 44 teachers at Skills Centers A and 55 teachers at Skills Center B, representing all seven vocational cluster areas taught at each facility (see

Table 4 for names of the clusters). The first question concerned the percentage of subject matter a particular teacher taught for which Sound-on-Slide units were available. Table 4 presents the names of the vocational clusters taught at each skills center, the number of teachers responding to the questionnaire who taught subjects in that cluster, and the range of percentages indicated by the teachers in response to the first question. Inspection of this table show the clusters at each facility in which the greatest number of Sound-on-Slide units were available, and the differences in availability of units between the two facilities. The usefulness of the PIVOT system and the ability of teachers to comment upon its usefulness is related to the degree of access which teachers have to the system, so the degree to which the system has thus far been implemented at the skills centers is of considerable interest.

Table 4

Availability of Sound-on-Slide Units at Each Skills Center, as Reported by Teachers in Each Cluster Area

Vocational Cluster	Skills Center A Number of Teachers Responding	Skills Center A Range of Percentages Reported*	Skills Center B Number of Teachers Responding	Skills Center B Range of Percentages Reported*
Business Educ. & Distribution	1	none	10	none
Communications	5	50 to 70%	8	0 to 30%
Construction	10	0 to 30%	9	0 to 70%
Health Services	5	0 to 80%	4	0.25 to 1%
Manufacturing & Maintenance	4	5 to 35%	6	0 to 5%
Personal Services	10	0 to 75%	8	0 to 50%
Power Mechanics	9	0 to 70%	10	0 to 15%
TOTALS:	44		55	

*in answer to Question 1 on the questionnaire distributed in June, 1979 (see Appendix G): "For about what percentage of the subject matter that you teach have you been provided with 3M Sound-on-Slide units?"

In most of the clusters listed in Table 4, a considerable range of availability of units is evident. The fact that most ranges start at zero means that in those clusters there were individual subjects for which no units were available. Ranges that start with a number larger than zero indicate that there were some units available in every subject taught in that cluster.

As one would expect from the fact that Skills Center B had only started to receive Sound-on-Slide units during the current year, the maximum percentages of their curriculum for which teachers said units were available were lower in Skills Center B than in Skills Center A in all but one cluster.

Teachers who had used the PIVOT system with their students in the skills centers were to complete the rest of the questionnaire, concerning the uses to which they had put the system, and their reactions to it. Since there were individual teachers in almost every cluster who had no PIVOT units, the total number of responses to items after the first one is less than the total number of respondents shown in Table 4. A summary of all questionnaire responses from Skills Centers A and B is presented in Appendix K. The discussion which follows concerns items which elicited the most consistent responses among large numbers of teachers.

As can be seen from the summarized results in Appendix K, the responses in the two skills centers were not markedly different for most items. In both centers, the most frequently cited use to which Sound-on-Slide units had been put was "Initial instruction in an area, with individual students," which agrees with the stated intent of the developers of the system. Many teachers had also used the units for review and for group instruction, and for helping absentees to "catch up."

Initial instruction with individual students was also the most frequently cited use when the teachers were asked to indicate the main use to which they had put the Sound-on-Slide units (Item 3).

At Skills Center A, 84.6% of the respondents said they had found the units "very effective" or "effective" in teaching the material covered in them, while 76.5% of the teachers at Skills Center B gave those answers to the same question. In answer to Item 6, which referred to use with Special Education students, of the 21 teachers who had had experience in using the units with such students, only one (at Skills Center A) found them "ineffective." Forty-one of 43 respondents at the two skills centers said that their students were generally able to understand the material in the Sound-on-Slide units, and 67.4% of the teachers said that their students were generally willing to use the units "without constant supervision and monitoring."

One item on which a difference was noted between the responses at the two skills centers was Item 10, which asked the teachers to rate the ruggedness and reliability of the Sound-on-Slide projectors. While 76.5% of the teachers at Skills Center B said that the projectors were "very" or "fairly" rugged and reliable, only 37.0% of the teachers at Skills Center A, where the teachers had been using the projectors for a much longer time, chose these two responses. Whether this is due to an improvement in

the machines during the interval between implementation at the two skills centers, to deterioration of the older machines, or to the teachers at Skills Center A simply having had more time in which to experience problems with them was beyond the scope of the present study to investigate. Since it is one of the few differences of opinion between the two groups of teachers, however, further investigation of the matter may be warrented.

Of 46 respondents at the two skills centers, 39 (84.8%) said that they felt the use of the Sound-on-Slide units had been beneficial to them and to their students, and 73.3% felt that the units had been "very useful" or "moderately useful" in helping them teach their subjects. Most teachers at the skills centers did not feel a need for more staff development time to learn to use the Sound-on-Slide materials (Item 19), but 79.3% of them said they felt a need for more time in which to develop materials (such as Student Review and Evaluation Sheets or slide units) to use with the PIVOT method. This feeling is perhaps explained by an examination of the responses to Item 21, in which teachers indicated reasons they had <u>not</u> yet used PIVOT materials, although they were available. Twelve said that the units did not cover what they wanted to teach, 10 that the content of the units was outdated, 13 that the equipment shown in the slide units did not match the equipment

in their shops, and 9 said that Student Review and Evaluation Sheets were not available. Since these responses were divided equally between the two skills centers, they obviously do not arise from problems of initial implementation, and would seem to be an inherent characteristic of the units currently available to the teachers.

Discussions with teachers and supervisors at the skills centers brought out many of the same points developed by an analysis of the questionnaire results. At Skills Center B, a particular individual had been assigned the task of helping the teachers in each area to implement the PIVOT system in their shops, and had been engaged in this activity since September, 1978. Therefore, the teachers at Skills Center B had a resource person at hand to consult about any problems that may have arisen, which may explain why even at Skills Center B the teachers felt no need to have more staff development time to learn to implement the PIVOT system.

One problem which teachers did have, however, was heard from a number of sources, including the individual mentioned, and that was that there were insufficient Sound-on-Slide units available in any one subject area to allow a student to progress through a substantial body of learning without any need for instruction by the teacher. A student might, for example, learn the fundamental steps in disassembling a piece of equipment

from slide units, but then have to be taught other operations by the teacher, because the units needed to complete the entire job were not available. This made some teachers reluctant to use the units. They were not able to allow the student to progress entirely on his own, since they could not teach the student an entire procedure without having to take time out from regular class instruction to teach things not covered by the units. This, and the need for units which more precisely matched the tasks the teachers wanted to teach, and the equipment in their shops, made the teachers want time in which to modify units or develop their own units, to suit their own needs. Thus, it is not that they felt the method was inadequate to meet their needs, but only that some of the materials available to them did not correspond to their perceived requirements. Some teachers said that they were willing to develop more suitable materials on their own, if time and supplies were provided.

CONCLUSIONS AND RECOMMENDATIONS

It can be stated on the basis of the data presented in the preceding section that the PIVOT method was capable of developing entry-level competency in students in each subject area and type of school involved in the study (see Table 1). In each setting, there were also individual students who did not develop entry-level competency as a result of their training by the PIVOT method, and who failed to successfully perform the criterion task. It was desired to determine, therefore, whether or not the number of students passing and failing the criterion task after instruction by the PIVOT method was significantly different from the number passing and failing after having been instructed by the classfront methods ordinarily used to teach the same subject matter. For this reason, the same criterion task was performed by students from comparable control classes who had been taught the same subject matter during the same school year by conventional methods. The rates of success and failure in the experimental and control groups were then compared separately in each setting, for each subject area, by use of either the Chi-square test or the Fisher Exact Probability Test.

As can be seen in Table 3, the rates of success and

failure in the experimental and control groups did not differ significantly, indicating that there was no significant difference between the effectiveness of the experimental and control methods of instruction in any of the subject areas and settings included in the study.

Since the PIVOT method is designed to require very little reading on the part of the student, the experimental and control groups in each setting and subject area were divided into two sub-groups: students with reading scores on the California Achievement Test which were below the 16th percentile, based on a test given in February, 1979 throughout the school district. When the rates of success and failure were compared in each of these new sub-groups for students trained by the experimental and control methods, there were once again no significant differences between the effectiveness of the two methods, indicating that both good readers and poor readers were as likely to succeed with the PIVOT method as they were with conventional instruction.

A further analysis of the data was done to determine whether students in the experimental and control groups who were below the 16th percentile in reading score had significantly different rates of success from their classmates in the same experimental or control groups who had reading scores at or above the 16th percentile. If there had been a significant difference in a control group, for example, but not in the

corresponding experimental group, in the same subject area and setting, it could have been said that the PIVOT method did not discriminate in effectiveness between good readers and poor readers, while the conventional method did, but no such significant differences were found.

Thus, on the basis of the statistical tests, it can be stated that no significant differences were found between the effectiveness of the PIVOT and conventional methods of instruction for any group or sub-group studied. This implies that the PIVOT method can be considered an alternative method of instruction which results in no loss of benefit to the student, compared to conventional instruction. Since the PIVOT method has certain intrinsic advantages as a means of individualized instruction, such as in situations where a student must work at a different rate or on different subject matter than the rest of a class, it can be used for such purposes with the assumption that the skills acquired will be equivalent to those which the student would have acquired through conventional instruction. In a totally individualized environment, such as a skills center, use of the PIVOT method would be just as effective as conventional instruction, and use of individualized methods becomes almost mandatory in that type of facility.

Reactions to the PIVOT system by teachers who had used it in class (both the experimental teachers in this

study and those in the skills centers) were quite favorable from the point of view of the effectiveness of the PIVOT method as a means of instruction. They indicated that students were willing to use the Sound-on-Slide projectors without excessive teacher involvement, that the students could understand the units, and that they could usually perform the tasks which the units were teaching. For implementation in an educational facility like a skills center, however, more is required than that the method of instruction have the theoretical or empirically determined ability to develop specific skills.

Unless instructional units are provided which teach the skills that the instructor wants his students to learn, using the equipment that he has in his shop, it is not possible to induce an instructor to use the PIVOT method with his students. It was specifically in this area, and in the area of reliability of the Sound-on-Slide projectors themselves, that most negative comments were elicited from the teachers at the skills centers who had had experience with the PIVOT method. This is in no sense a criticism of the method of instruction; many individual teachers indicated that they were impressed with the potential of the system, but disappointed by the lack of relevance to their needs of the materials provided them. This would appear to be the essential difference between effectiveness, as measured experimentally, and usefulness in actual implementation.

Thus, two recommendations emerge, in light of the demonstrated effectiveness of the PIVOT instructional method with both EMR and regular students. First, implementation of the PIVOT system at any facility should involve an intensive effort to determine what types of skills are being taught (or desired), and whether or not Sound-on-Slide units do, in fact, exist which teach those skills in a way that the faculty of the educational facility will accept. Once such units are located, or written (possibly by the faculty itself), adequate maintenance of the audio-visual equipment used with the units must be provided, so that teachers do not experience frustration and delays in trying to utilize defective equipment. The suggestion was also made by more than one teacher that the Sound-on-Slide projectors be modified to make them more "student-proof," from the standpoint both of accidental abuse and deliberate malice.

It is very beneficial, as demonstrated at Skills Center B in the present study, to provide a full-time staff member whose duties involve helping faculty members implement the PIVOT system in their shops. There are many logistical problems to be solved when this type of system is first implemented. Teachers become frustrated when there are long delays in acquisition of essential materials and supplies, and lose interest in using the new system. Early resolution of difficulties should be considerable help to its potential users and their students.

Appendix A

Sound-on-Slide Units Named in the Proposal for Use in the Study

NURSING ASSISTANT D.O.T. 355

Task 1: Put On and Remove Face Mask
Task 2: Put On and Remove Sterile Gloves
Task 3: Filling and Applying the Ice Bag
Task 4: Filling and Applying Hot Water Bag
Task 5: Collect Urine Specimen
Task 6: Collect 24 Hour Urine Specimen
Task 7: Taking the Radial Pulse
Task 9: Handwashing
Task 10: Taking Apical Pulse

ELECTRICAL CONSTRUCTION D.O.T. 824

Task 1: Install a Twist Type Solderless Connector
Task 2: Install a Set Screw Type Solderless Connector
Task 3: Install a Solderless Terminal on a Wire
Task 4: Wire a three Wire Grounded Plug
Task 5: Wire a Three Wire Grounded Cord Connector
Task 6: Punch a Hole for Half Inch Electrical Fitting
Task 7: Punch a Half Inch Knockout Hole to a Larger Size
Task 8: Check for Line Voltage in a Fuse Panel with a Neon Tester
Task 9: Check the Main Fuses ina Fuse Panel with a Neon Tester
Task 10: Check the Range Fuses in a Fuse Panel with a Neon Tester
Task 11: Check the Plug Fuses in a Fuse Panel with a Neon Tester
Task 12: Replace Defective Cartridge Fuses in a Fuse Panel Pullout
Task 13: Replace Defective Plug Fuses in a Fuse Panel
Task 14: Check Plug Fuses with a Continuity Tester
Task 15: Check Cartridge Fuses with a Continuity Tester
Task 16: Install Cartridge Fuses in a Safety Switch
Task 17: Reset a Tripped Circuit Breaker
Task 18: Check a Fuse with an Ohmmeter
Task 19: Check a Fuse with a Voltmeter
Task 20: Replace Burned out Fuse Links

MACHINE SHOP D.O.T. 600

Task 1: Drill and Countersink a Hole

A. Laying Out for a Hole
B. Mounting the Work and Drill
C. Drilling the Hole
D. Mounting a Countersink
E. Countersinking the Hole
F. Breaking Down and Cleaning Up

Task 2: Drill a Blind Hole

- A. Laying Out for a Blind Hole
- B. Mounting the Counterdrill and Workpiece
- C. Counterdrilling and Workpiece
- D. Mounting a Taper Shank Drill
- E. Clamping a Drill Press Vise
- F. Setting the Stop for a 1/2" deep Hole
- G. Drilling a Blind Hole
- H. Breaking Down and Cleaning Up

Task 3: Spotface Two Holes on a Casting on the Drill Press

- A. Laying Out the Holes on a Casting
- B. Mounting the work and Drill
- C. Drilling Two Holes in a Casting
- D. Mounting the Spotface
- E. Spotfacing Two Holes
- F. Breaking Down and Cleaning Up

Task 4: Counterbore a Hole on a Drill Press

- A. Laying Out a Hole for Counterboring
- B. Mounting the Drill and Workpiece
- C. Drilling a Hole
- D. Mounting the Counterbore
- E. Setting the Stop for a 5/16" deep Hole
- F. Counterboring a Hole
- G. Breaking Down and Cleaning Up

Task 5: Centerdrill Round Stock on a Drill Press

- A. Laying Out the End of Stock
- B. Mounting the Centerdrill and Workpiece
- C. Centerdrilling a Hole in Round Stock
- D. Breaking Down and Cleaning Up

Appendix B

Checklist of Possible Defects in Sound-on-Slide Units and List of Definitions of Those Defects

Name of Unit_____ Unit number___ ___

Slide Number	Safety (unsafe method)	Poor slide quality	Bad camera angle	Incorrect set-up or arrows wrong	Incorrect procedure shown	Poor sound track (recording quality)	Misc. (specify below)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Over-all problems (illogical sequence, etc.), and "Misc." from above:

Definitions of Column Headings on Slide Evaluation Form

Safety (unsafe method) -- This refers to any procedures or techniques shown in the slide or described in the script which present an unnecessary safety hazard to the student. It can also be used to indicate that the method shown is not as safe as one now used in industry, even though it was once considered acceptable.

Poor slide quality -- This refers to the photographic quality of the slide, such as lighting, visibility of drawn lines, focus, or poor color quality (where relevant).

Bad camera angle -- Refers to the composition of the picture, the distance from the subject, failure to include important items in the picture, use of an angle (such as directly down from the ceiling) from which a student could not see the subject (and which is therefore of little use to him in understanding the material).

Incorrect set-up or arrows wrong -- To be used when the equipment shown is not appropriate for what the sound track describes, or is not what is needed for the task, or when the arrows included in some pictures point to the wrong things, or in the wrong direction.

Incorrect procedure shown -- To be used when the procedure described is not one that is considered acceptable, according to the usual standards of the industry. That is, when mastery of the technique shown would cause a student to do a job in an unacceptable way.

Poor sound track (recording quality) -- Words unintelligible, part of sound track clipped off in recording, distracting noises on sound track, etc.

Misc. -- Any other defect in the individual slide/sound track which could and should be corrected, to improve the quality of the slide. Over-all defects in the entire unit will be described at the bottom of the page.

Appendix C

Units Selected for Use in the Study

ELECTRICAL CONSTRUCTION UNITS

Task 1: Install a Twist Type Solderless Connector

Task 2: Install a Set Screw Type Solderless Connector

Task 3: Install a Solderless Terminal on a Wire

Task 4: Wire a Three Wire Grounded Plug

Task 5: Wire a Three Wire Grounded Cord Connector

Task 6: Check for Line Voltage in a Fuse Panel with a Neon Tester

Task 7: Check the Main Fuses in a Fuse Panel with a Neon Tester

Task 8: Check the Range Fuses in a Fuse Panel with a Neon Tester

Task 9: Check the Plug Fuses in a Fuse Panel with a Neon Tester

Task 10: Replace Defective Cartridge Fuses in a Fuse Panel

Task 11: Replace Defective Plug Fuses in a Fuse Panel

Task 12: Check Plug Fuses with a Continuity Tester

Task 13: Check Caryridge Fuses with a Continuity Tester

Task 14: Install Cartridge Fuses in a Safety Switch

Task 15: Reset a Tripped Circuit Breaker

Task 16: Check a Fuse with an Ohmmeter

Task 17: Check a Fuse with a Voltmeter

Task 18: Replace Burned out Fuse Links

MACHINE SHOP UNITS

Task 1: Drill and Countersink a Hole

- A. Laying Out for a Hole
- B. Mounting the Work and Drill
- C. Drilling the Hole
- D. Mounting a Countersink
- E. Countersinking the Hole
- F. Breaking Down and Cleaning Up

Task 2: Drill a Blind Hole

- A. Laying Out for a Blind Hole
- B. Mounting the Centerdrill and Workpiece
- C. Centerdrilling the workpiece
- D. Mounting a Taper Shank Drill
- E. Clamping a Drill Press Vise
- F. Setting the Stop for a 1/2" deep Hole
- G. Drilling a Blind Hole
- H. Breaking Down and Cleaning Up

Task 3: Spotface Two Holes on a Casting on the Drill Press

- A. Laying Out the Holes on a Casting
- B. Mounting the Work and Drill
- C. Drilling Two Holes in a Casting
- D. Mounting the Spotface
- E. Spotfacing Two Holes
- F. Breaking Down and Cleaning Up

NURSING ASSISTANT UNITS

Task 1: Handwashing
Task 2: Put On and Remove Face Mask
Task 3: Filling and Applying Ice Bag
Task 4: Filling and Applying Hot Water Bottle
Task 5: How to Disinfect and Empty Unit
Task 6: Make a Bed
Task 7: Moving the Patient Up in the Bed
Task 8: Collect Urine Specimen

Appendix D

Test Instruments Used with the Criterion Tasks

ELECTRICAL CONSTRUCTION TEST

Work Station: Main/Range Fuse Panel

Instructions to Student

(1) Check to see that there is line voltage in the panel.

(2) Find the defective fuses, if any, in the panel.

(3) Remove any defective fuses and demonstrate that they are defective.

(4) Replace the defective fuses with good ones.

Your performance will be judged on the basis of whether or not you followed correct procedures to do the job, and successfully corrected and defects. There is no specific time limit, but you should work at an efficient pace.

Electrical Construction Test

Student's name_____Book No._____

School_____Grader's Name_____Date_____

In this test, the student is expected to check a main/range fuse panel for line voltage and then to locate any defective fuses in the panel. He will then verify that the fuse is defective, and replace it with a good one (there will only be one defective fuse in the panel, but there may also be no defective fuses). The checklist below is a guide to follow in the evaluation of how effectively the student completed this task. After the student has completed the task, please assign him a grade of Pass or Fail.

1. Was the student safely attired?
2. Did the student correctly check for line voltage?
3. Was the student able to locate the defective fuse?
4. Did the student correctly check the defective fuse to verify that it was defective?
5. Did the student replace the fuse correctly?
6. Did he test the operation of the unit?
7. Did the student observe correct safety procedures and care for the equipment properly?

On the basis of what you have seen, decide whether or not the student has done this job well enough to be said to have developed "entry level competency" in this task. On the basis of <u>your</u> judgment, check Pass or Fail, below.

☐ Pass ☐ Fail

Machine Shop Test

Instructions to Student:

Locate the center of one surface of the workpiece provided. Using the drill provided, drill a 1/2" deep hole into the workpiece. Then countersink the hole to fit the head of the flat-head screw provided. Break down and clean up the work station.

Your performance will be judged on the basis of whether or not you followed correct procedures in doing the job, and the quality of the finished job. There is no specific time limit, but you should work at an efficient pace.

Machine Shop Test

Student's name_____Book No._____

School_____Grader's Name_____Date_____

In this test, the student is expected to correctly locate the center of the workpiece, centerpunch the center, set up the drill press and workpiece correctly, drill a hole 1/2" deep, mount a countersink in the drill press, countersink the hole to fit the screw provided, and then break down and clean up the drill press. The checklist below is intended as a guide to follow in evaluating how well the student completed this task.

1. Was the student safely attired?
2. Was the center of the workpiece located properly?
3. Was the work centerpunched?
4. Was the work mounted in the vise correctly?
5. Was the drill mounted correctly?
6. Did the student set the depth stop correctly?
7. Was the vise positioned properly?
8. Did the student drill the hole correctly?
9. Did the student mount the countersink correctly?
10. Was the workpiece countersunk correctly?
11. Did the student correctly break down and clean up the work station?
12. Did the student observe correct safety procedures and care for the equipment properly?

On the basis of what you have seen, please decide whether or not the student has done this job well enough to be said to have developed "entry level competency" in this task. On the basis of your judgment, check Pass or Fail, below.

☐ Pass ☐ Fail

Nursing Assistant Test

Instructions to Student

Using the methods you have been taught in this course, please do the following things:

(1) Wash your hands.

(2) Fill a hot water bag.

(3) Move the patient up in the bed and then apply the hot water bag to the patient's side.

You will be graded on how well you did these things, according to what you have been taught. There is no exact time limit, but you should work at a reasonable speed.

Nursing Assistant Test

Student's name_____ Book No._____

School_____Grader's name_____Date_____

In this test, the student is expected to wash his hands, fill a hot water bag, move a patient up in bed, and then apply the hot water bag to the patient's side. The checklist below is a guide for you to follow in evaluating how well the student did these things. After the student has completed the test, please assign him a grade of Pass or Fail.

1. Did the student remove jewelry before washing his hands?
2. Did the student use sufficient friction in washing?
3. Were the hands held at the right angle during rinsing?
4. Was the faucet turned off properly, with a paper towel?
5. Did the student test the hot water bag for leaks?
6. Did the student check the temperature of the water?
7. Did the student fill the bag half full of water and expel the air?
8. Did the student put the hot water bag in the muslin cover?
9. Did the student greet the patient and explain what he was going to do?
10. Did the student screen the unit?
11. Did the student lower the head of the bed before starting to move the patient up in the bed?
12. Did the student flex the patient's knees and cradle the patient properly?
13. Did the student apply the hot water bag properly?

On the basis of what you have seen, decide whether or not the student has done this job well enough to be said to have developed "entry level competency" in this task. On the basis of <u>your</u> judgment, check Pass or Fail, below.

☐ Pass ☐ Fail

Appendix E

Examples of Student Review and Evaluation Sheets Used with Sound-on-Slide Units

STUDENT REVIEW AND EVALUATION SHEET

TASK: 7. Check the Main Fuse in a Fuse Panel with a Neon Tester

UNIT OF OPERATION: Check the Main Fuses in a Fuse Panel with a Neon Tester

PROVIDED: A Wadsworth main range and four fuse panel connected to a single phase 120/240 volt service, neon tester safety glasses.

CRITERIA: Student will check the main fuses in a fuse panel with a neon tester without removing the pull-out from the fuse panel, there will be no injury to himself or damage to the equipment.

OVERVIEW: Electricians are often required to check the main fuses in a fuse panel pull-out without removing the pull-out in all types of residential and commercial buildings.

Before you call your instructor for evaluation, check yourself on the STUDENT CHECKLIST below.

STUDENT CHECKLIST DID YOU:		INSTRUCTOR CHECKLIST DID THE LEARNER:
☐	1. Open the fuse panel	☐
☐	2. Locate bottom holes on main pull-out	☐
☐	3. Position leads correctly without touching bare metal ends of test leads	☐
☐	4. Determine if fuse is good or defective	☐
☐	5. Remove neon tester from panel	☐
☐	6. Close fuse panel cover	☐
☐	7. Make sure that there was no damage to equipment or injury to self	☐
	Instructor: Did the learner check the main fuse in a fuse panel with a neon tester?	☐

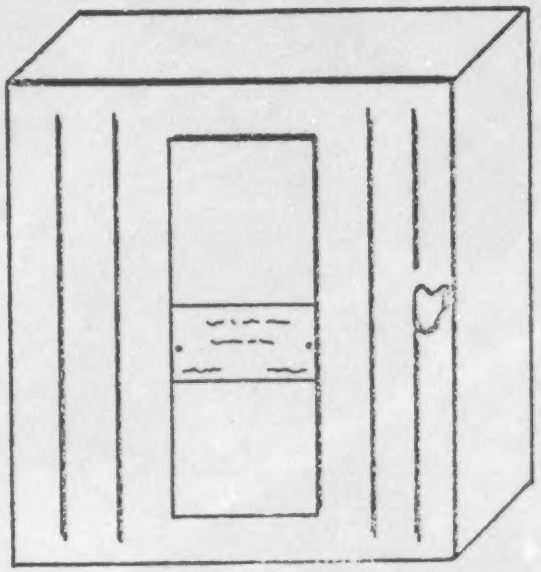
Completion of Unit Approved by _____

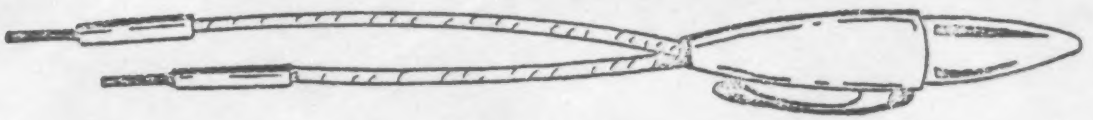
Authorized Signature

WORK STATION

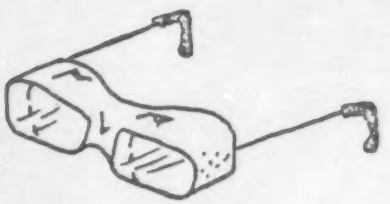
TASK: 7. Check the Main Fuse in a Fuse Panel with a Neon Tester

UNIT OF OPERATION: Check the Main Fuses in a Fuse Panel with a Neon Tester





NEON TESTER



SAFETY GLASSES

STUDENT REVIEW AND EVALUATION SHEET

TASK: 1. Drill and Countersink a Hole

UNIT OF OPERATION: (1-C) Drilling the Hole

PROVIDED: Drill press (speed and table height set) with Jacob's chuck and 5/16" drill mounted, workpiece and parallels (mounted in drill press vise), oil can, apron and safety glasses.

CRITERIA: The learner will drill a 5/16" hole through the workpiece at the layout, observing all safety regulations.

OVERVIEW: Drilling a hole in metal is the simplest task on the drill press, but there are definite steps the learner must follow to drill the hole accurately to avoid injury to himself or damage to the equipment.

Before you call your instructor for evaluation, check yourself on the STUDENT CHECKLIST below.

STUDENT CHECKLIST DID YOU:		INSTRUCTOR CHECKLIST DID THE LEARNER:
☐	1. Drill the hole through the workpiece	☐
☐	2. Observe all safety regulations	☐
	Instructor: Did the learner drill the hole?	☐

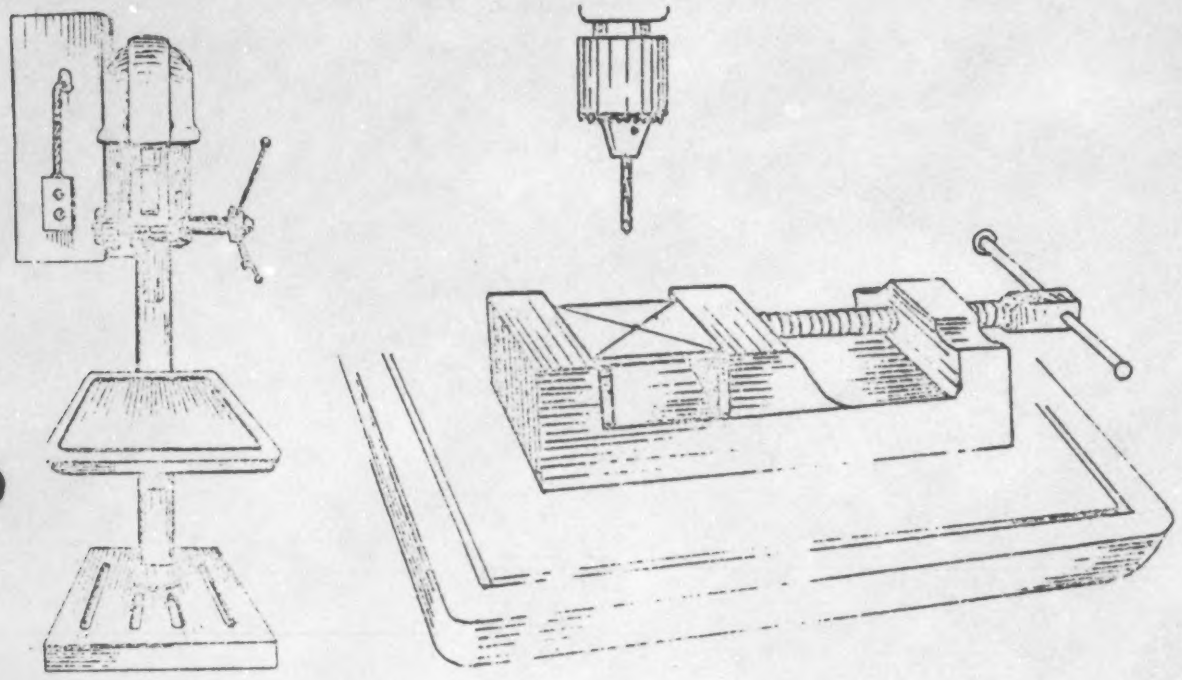
Completion of Unit Approved by _____

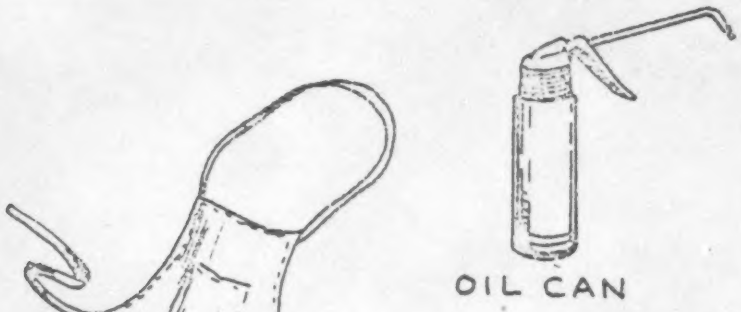
Authorized Signature

WORK STATION

TASK: 1. Drill and Countersink a Hole

UNIT OF OPERATION: (1-C) Drilling the Hole





OIL CAN

SAFETY GOGGLES

APRON

Appendix F

Memorandum Concerning Final

Testing Schedule

THE SCHOOL DISTRICT OF PHILADELPHIA

MEMORANDUM

TO	NAME AND OFFICE All teachers involved in the PIVOT II Research Project	FILE NO.
		DATE 10/30/78
FROM	NAME AND OFFICE Allen Collins & Leonard Kindler	SENDER'S TELEPHONE 299-7056, 7165
SUBJECT	Testing Schedule for Criterion Tests to be administered in all subject areas	

In order to provide for systematic and orderly testing procedures, we will conduct all testing in the individual subject areas during the time intervals shown below. Therefore, please plan to complete instruction of your students by the date shown in the last column, below, for your subject area. Complete information about scheduling the tests and materials that will be needed for testing will be provided an adequate length of time before testing begins.

Subject Area	Test Sessions During	Plan to Complete Instruction by:
Nurse's Aide	January 16 to Feb. 28	Jan. 12, 1979
Machine Shop	March and April	Feb. 28, 1979
Electrical Constr.	April and May	March 30, 1979

FORM B 30—MEMORANDUM—SCHOOL DISTRICT OF PHILADELPHIA (JUNE 1968)

Appendix G

Questionnaire Completed by

Teachers at the Skills Centers

Name_____ Cluster_____No._____

Occ. Area_____No._____

1. For about what percentage of the subject matter that you teach have you been provided with 3M Sound-on-Slide units? 1_____%

2. Check those uses to which you have so far put 3M Sound-on-Slide units (check all that apply):

___a. Initial instruction in an area, with individual students
___b. Review of previously taught material, with individual students
___c. Initial instruction in an area, with groups of students
___d. Review of previously taught material, with groups of students
___e. Helping absentees to "catch up"

___f. As a teaching aid while instructing the whole class at once
___g. Other (describe on back of page, please)

___h. Not used at all so far

NOTE: If you checked "h" in Item 2, omit questions 3 to 14 and answer only questions 15 to 22. If you did not check "h" in Item 2, please answer all of the following questions, from 3 to 22.

3. Give the letter of the choice in Item 2 that represents the main use to which you have put the 3M Sound-on-Slide units. 3_____

4. During what percentage of class time would you estimate that the 3M Sound-on-Slide units are in use in your classes (in any way)? 4_____

5. How effective do you feel the units used in your classes are in teaching the material covered in them?
(A) very effective (B) effective
(C) ineffective (D) very ineffective 5_____

6. How effective have you found the units to be with Special Education students?
(A) very effective (B) effective
(C) ineffective (D) very ineffective
(E) not applicable--have not been used with such students 6_____

7. How enthusiastic are you about using the Sound-on-Slide units you have been given instead of the method you would ordinarily use to teach the same material?
   (A) very enthusiastic (B) enthusiastic
   (C) reluctant (D) very reluctant
   7_____

8. Does it seem that your students are <u>generally</u> able to understand the material in the Sound-on-Slide units? (answer yes or no)
   8_____

9. Do your students generally seem willing to use these units without constant supervision and monitoring? (yes or no)
   9_____

10. How would you rate the ruggedness and reliability of the 3M Sound-on-Slide projectors, based on your personal experience with them in classroom use?
   (A) very rugged and reliable
   (B) fairly rugged and reliable
   (C) somewhat troublesome, requiring fairly frequent maintenance
   (D) very troublesome, requiring very frequent maintenance
   10_____

11. How much involvement on your part is necessary in order for your students to be able to learn successfully from the Sound-on-Slide units?
   (A) a great deal (B) a moderate amount
   (C) very little (D) almost none at all
   11_____

12. How appropriate and useful have you found the Student Review and Evaluation Sheets (SRES's) that came with your units?
   (A) very appropriate and useful
   (B) somewhat appropriate and useful
   (C) somewhat inappropriate and not particularly useful
   (D) very inappropriate and generally useless
   (E) no such materials were provided with the units
   12_____

13. Do you feel that the use of the Sound-on-Slide units has, for the most part, been beneficial to you and your students?
   (A) very beneficial (B) somewhat beneficial
   (C) not very beneficial (D) not beneficial at all
   13_____

14. How useful do you feel the Sound-on-Slide units you have been given have been in helping you teach your subject(s) this year?
   (A) very useful (B)moderately useful
   (C) not of much use (D) of almost no use at all
   14_____

15. Have you had any difficulties in implementing the 3M Sound-on-Slide units in your classes? (answer yes or no) 15_____
If you answered "yes" to Item 15, please explain briefly on the back of this page what sort of difficulties you have had.

16. Do you feel, based on your experience with the students you have met, that the use of Sound-on-Slide units is necessary in order for you to be able to successfully conduct your classes?
(A) very necessary (B) somewhat necessary
(C) not particularly necessary
(D) not necessary at all 16_____

17. Do you feel it is a good idea to use the Sound-on-Slide method of instruction as a major part of the curriculum in your subject area?
(A) an excellent idea (B) a good idea
(C) somewhat doubtful
(D) probably not a good idea 17_____

18. Do you feel that the Sound-on-Slide method is best used as an aid to conventional instruction, rather than as a major curriculum component?
(A) definitely (B) probably
(C) probably not (D) definitely not 18_____

19. Do you feel a need for more staff development sessions, to learn to use the Sound-on-Slide materials more effectively? (answer yes or no) 19_____

20. Do you feel a need for more time in which to develop materials (such as SRES's or slide units) to use with the PIVOT method? (yes or no) 20_____

21. If you have Sound-on-Slide units, but have not yet used them in any way, please check below any factors that explain why you have not yet used them.

____a. Student Review and Evaluation Sheets are not available.
____b. Have not had enough time to set up work stations.
____c. No place in my shop to set up work stations.
____d. Units supplied do not cover what I want to teach.
____e. Content of units is outdated.

(choices continue on next page)

____f. Equipment shown in slides does not match the equipment in my shop.

____g. Picture quality in slides is inadequate.

____h. Sound quality of recordings is inadequate.

____i. Other (specify):

22. Since the main purpose of this questionnaire is to determine your reactions to the Sound-on-Slide units, we would appreciate any additional comments that will serve either to explain your responses to these questions or to clarify other feelings you may have about the units. Feel free to mention anything that you feel is important, especially if you feel it was not dealt with adequately in the preceding questions.

Appendix H

Questionnaire Completed by Teachers of the Experimental Classes

PIVOT RESEARCH PROJECT — EXPERIMENTAL GROUP QUESTIONNAIRE

Name_____ Shop Area_____ School_____

Your answers to the following questions will be of considerable help to us in evaluating the effectiveness of the 3M Sound-on-Slide materials that you used in class. Please answer all questions as completely as possible, especially those that request further information concerning your reactions. In all cases, what is desired is your personal reaction, based on your own experience with the specific slide units that you used.

1. How effective do you think the 3M Sound-on-Slide units used in your classes were in teaching the material covered in them?
   (A) very effective (B) effective
   (C) ineffective (D) very ineffective 1_____
2. How enthusiastic are you about using the Sound-on-Slide units you have been given instead of the method you would ordinarily use to teach the same material?
   (A) very enthusiastic (B) enthusiastic
   (C) reluctant (D) very reluctant 2_____
3. Does it seem to you that your students were generally able to understand the material in the Sound-on-Slide units? (answer yes or no) 3_____
4. Did your students generally seem willing to use these units without constant supervision and monitoring? (yes or no) 4_____
5. Did you have any difficulties in implementing the 3M Sound-on-Slide units in your class? (answer yes or no) 5_____
   If your answer to #5 was "yes," please describe on the back of this page the difficulties that you had.
6. How would you rate the ruggedness and reliability of the 3M projectors that your students used in class?
   (A) very rugged and reliable
   (B) fairly rugged and reliable
   (C) somewhat troublesome, requiring fairly frequent maintenance
   (D) very troublesome, requiring very frequent maintenance 6_____
7. How much involvement on your part was necessary for your students to be able to learn from the Sound-on-Slide units?
   (A) a great deal (B) a moderate amount
   (C) very little (D) almost none at all 7_____
8. How appropriate and useful have you found the pre-tests, post-tests and Student Review and Evaluation Sheets that came with your units?
   (A) very appropriate and useful
   (B) somewhat appropriate and useful
   (C) somewhat inappropriate and not particularly useful
   (D) very inappropriate and generally useless
   (E) no such materials were provided with the units 8_____

9. How useful do you feel the Sound-on-Slide units that you have been given have been in helping you to teach your subject this year?
   (A) very useful (B) moderately useful
   (C) not of much use (D) of almost no use at all 9_____

10. Do you feel that the use of the Sound-on-Slide units has, for the most part, been beneficial to you and your students?
   (A) very beneficial (B) somewhat beneficial
   (C) not very beneficial (D) not beneficial at all 10_____

11. Do you feel it is a good idea to use the Sound-on-Slide method of instruction as a major part of the curriculum in your subject area?
   (A) an excellent idea (B) a good idea
   (C) somewhat doubtful (D) probably not a good idea 11_____

12. Do you feel that the Sound-on-Slide method is best used as an aid to conventional instruction, rather than as a major curriculum component?
   (A) definitely (B) probably
   (C) probably not (D) definitely not 12_____

13. Do you feel that the Sound-on-Slide units you have been given fit the conditions and materials in your own shop? (answer yes or no) 13_____
   If you answered "no" to # 13, please explain your answer in more detail on the back of this page.

14. Do the techniques shown in the Sound-on-Slide units agree with what you would consider a proper way to do the jobs shown?
   (A) almost always (B) usually
   (C) sometimes (D) seldom 14_____

15. Have you noticed any deficiencies in the physical quality of the slide units themselves? That is, any deficiencies in the quality of the photography, camera angles, sound tracks, etc., that impede student use of the units? (answer yes or no) 15_____
   If you answered "yes" to # 15, please describe the deficiencies that you have noted on the back of this page.

16. Which of the following best describes your students' reaction to using the Sound-on-Slide method in class?
   (A) very enthusiastic (B) enthusiastic
   (C) somewhat reluctant (D) very reluctant 16_____

17. What impact on classroom management has the introduction of of the Sound-on-Slide method had in your classes?
   (A) it has made classroom management easier
   (B) there has been no change in classroom management problems
   (C) it has made classroom management more difficult 17_____

18. Are your students able to successfully complete the units that they are given?
   (A) always (B) very often
   (C) not very often (D) almost never 18_____

19. Do you feel a need for more staff development than you received in order to be able to use the Sound-on-Slide method successfully? (answer yes or no; if you answer "yes," an explanation on the back of this page would be appreciated.) 19_____

20. How important do you think it is that the equipment shown in a Sound-on-Slide unit exactly match the equipment in the shop where the unit is to be used?
    (A) extremely important (B) important
    (C) not very important (D) not important at all 20_____
21. Would you be willing to write Sound-on-Slide units specifically for use in your own shop? (answer yes or no; feel free to expand on your answer, if you wish) 21_____
22. Would you be willing to write Sound-on-Slide units for use in other teachers' shops? (yes or no) 22_____

23. Since the main purpose of this questionnaire is to determine your reactions to the Sound-on-Slide units, we would appreciate any comments you may have that will either serve to explain some of your responses to these questions or to clarify your feelings about the units. Please indicate on the back of this page anything that you feel is important, especially those things that you think were not dealt with adequately in the preceding questions.

Appendix I

Questionnaire Responses of the Teachers of the Experimental Classes in Machine Shop and Industrial Electricity

PIVOT RESEARCH PROJECT — EXPERIMENTAL GROUP QUESTIONNAIRE

Name Machine Shop and Ind. Elec. Teachers Shop Area _____ School _____

Your answers to the following questions will be of considerable help to us in evaluating the effectiveness of the 3M Sound-on-Slide materials that you used in class. Please answer all questions as completely as possible, especially those that request further information concerning your reactions. In all cases, what is desired is your personal reaction, based on your own experience with the specific slide units that you used.

1. How effective do you think the 3M Sound-on-Slide units used in your classes were in teaching the material covered in them?
   (A) very effective (B) effective
   (C) ineffective (D) very ineffective
   3A 8B 1. 1C
2. How enthusiastic are you about using the Sound-on-Slide units you have been given instead of the method you would ordinarily use to teach the same material?
   (A) very enthusiastic (B) enthusiastic
   (C) reluctant (D) very reluctant
   3A 5B 2. 4C
3. Does it seem to you that your students were generally able to understand the material in the Sound-on-Slide units? (answer yes or no)
   11Y 3. 1N
4. Did your students generally seem willing to use these units without constant supervision and monitoring? (yes or no)
   11Y 4. 1N
5. Did you have any difficulties in implementing the 3M Sound-on-Slide units in your class? (answer yes or no)
   If your answer to #5 was "yes," please describe on the back of this page the difficulties that you had.
   3Y 5. 9N
6. How would you rate the ruggedness and reliability of the 3M projectors that your students used in class?
   (A) very rugged and reliable
   (B) fairly rugged and reliable
   (C) somewhat troublesome, requiring fairly frequent maintenance
   (D) very troublesome, requiring very frequent maintenance
   2A 9B 6. 1C
7. How much involvement on your part was necessary for your students to be able to learn from the Sound-on-Slide units?
   2A 7. 4B 5C 1D
8. How appropriate and useful have you found the pre-tests, post-tests and Student Review and Evaluation Sheets that came with your units?
   (A) very appropriate and useful
   (B) somewhat appropriate and useful
   (C) somewhat inappropriate and not particularly useful
   (D) very inappropriate and generally useless
   (E) no such materials were provided with the units
   2A 7B 2C 8. 1E

9. How useful do you feel the Sound-on-Slide units that you have been given have been in helping you to teach your subject this year?
   (A) very useful (B) moderately useful
   (C) not of much use (D) of almost no use at all
   4A 4B 9. 4C

10. Do you feel that the use of the sound-on-Slide units has, for the most part, been beneficial to you and your students?
   (A) very beneficial (B) somewhat beneficial
   (C) not very beneficial (D) not beneficial at all
   4A 7B 10. 1C

11. Do you feel it is a good idea to use the Sound-on-Slide method of instruction as a major part of the curriculum in your subject area?
   3A 3B 11. 6C

12. Do you feel that the sound-on-Slide method is best used as an aid to conventional instruction, rather than as a major curriculum component?
   (A) definitely (B) probably
   (C) probably not (D) definitely not
   10A 12. 2B

13. Do you feel that the Sound-on-Slide units you have been given fit the conditions and materials in your own shop? (answer yes or no)
   If you answered "no" to #13, please explain your answer in more detail on the back of this page.
   8Y 13. 4N

14. Do the techniques shown in the Sound-on-Slide units agree with what you would consider a proper way to do the jobs shown?
   (A) almost always (B) usually
   (C) sometimes (D) seldom
   5A 14. 7B

15. Have you noticed any deficiencies in the physical quality of the slide units themselves? That is, any deficiencies in the quality of the photography, camera angles, sound tracks, etc., that impede student use of the units? (answer yes or no)
   If you answered "yes" to #15, please describe the deficiencies that you have noted on the back of this page.
   1Y 15. 11N

16. Which of the following best describes your students' reaction to using the Sound-on-Slide method in class?
   (A) very enthusiastic (B) enthusiastic
   (C) somewhat reluctant (D) very reluctant
   2A 9B 16. 1C

17. What impact on classroom management has the introduction of the Sound-on-Slide method had in your classes?
   (A) it has made classroom management
   (B) there has been no change in classroom management problems
   (C) it has made classroom management more difficult
   2A 9B 17. 1C

18. Are your students able to successfully complete the units that they are given?
   (A) always (B) very often
   (C) not very often (D) almost never
   6A 18. 6B

19. Do you feel a need for more staff development than you received in order to be able to use the Sound-on-Slide method successfully? (answer yes or no; if you answer "yes," an explanation on the back of this page would be appreciated.)
   2Y 19. 10N

20. How important do you think it is that the equipment shown in a Sound-on-Slide unit exactly match the equipment in the shop where the unit is to be used?
    (A) extremely important (B) important
    (C) not very important (D) not important at all

    4A
    7B
20 1C

21. Would you be willing to write Sound-on-Slide units specifically for use in your own shop? (answer yes or no; feel free to expand on your answer, if you wish)

    10Y
21 1N

22. Would you be willing to write Sound-on-Slide units for use in other teachers' shops? (yes or no)

    7Y
22 4N

23. Since the main purpose of this questionnaire is to determine your reactions to the Sound-on-Slide units, we would appreciate any comments you may have that will either serve to explain some of your responses to these questions or to clarify your feelings about the units. Please indicate on the back of this page anything that you feel is important, especially those things that you think were not dealt with adequately in the preceding questions.

Appendix J

Questionnaire Responses of the

Teachers of the Experimental EMR

Nursing Assistant Classes

PIVOT RESEARCH PROJECT — EXPERIMENTAL GROUP QUESTIONNAIRE

Name Nursing Assistant Teacher Shop Area _____ School N=4

Your answers to the following questions will be of considerable help to us in evaluating the effectiveness of the 3M Sould-on-Slide materials that you used in class. Please answer all questions as completely as possible, especially those that request forther information concerning your reactions. In all cases, what is desired is your personal reaction, based on your own experience with the specific slide units that you used.

1. How effective do you think the 3M Sound-on-Slide units used in your classes were in teaching the material covered in them?
   (A) veryeffective (B) effective
   (C) ineffective (D) very ineffective
   1A 1 3B
2. How enthusiastic are you about using the Sould-on-Slide units you have been given instead of the method you would ordinarily use to teach the same material?
   (A) very enthusiastic (B) enthusiastic
   (C) reluctant (D) very reluctant
   1A 2 3B
3. Does it seem to you that your students were generally able to understand the material in the Sound-on-Slide units? (answer yes or no)
   3 4Y
4. Did your students generally seem willing to use these units without constant supervision and monitoring? (yes or no)
   4 4N
5. Did you have any difficulties in implementing the 3M Sound-on-Slide units in your class? (answer yes or no)
   If your answer to #5 was "yes," please describe on the back of this page the difficulties that you had.
   5 4N
6. How would you rate the ruggedness and reliability of the 3M projectors that your students used in class?
   (A) very rugged and reliable
   (B) fairly rugged and reliable
   (C) somewhat troublesome, requiring fairly frequent maintenance
   (D) very troublesome, requiring very frequent maintenance
   1A 6 3B
7. How much involvement on your part was necessary for your students to be able to learn from the Sound-on-Slide units?
   (A) a great deal (B) a moderate amount
   (C) very little (D) almost none at all
   7 4B
8. How appropriate and useful have you found the pre-tests, post-tests and Student Review and Evaluation Sheets that came with your units?
   (A) very appropriate and useful
   (B) somewhat appropriate and useful
   (C) somewhat inappropriate and not particularly useful
   (D) very inappropriate and generally useless
   (E) no such materials were provided with the units
   8 4E

9. How useful do you feel the Sound-on-Slide units that you have been given have been in helping you to teach your subject this year?
   (A) very useful (B) moderately useful
   (C) not of much use (D) of almost no use at all
   9 1B 3A

10. Do you feel that the use of the Sound-on-Slide units has, for the most part, been beneficial to you and your students?
   (A) very beneficial (B) somewhat beneficial
   (C) not very beneficial (D) not beneficial at all
   10 4A

11. Do you feel it is a good idea to use the S und-on-Slide method of instruction as a major part of the curriculum in your subject area?
   (A) an excellent idea (B) a good idea
   (C) somewhat dobtful (D) probably not a good idea
   11 3B 1C

12. Do you feel that the Sound-on-Slide method is best used as an aid to conventional instruction, rather than as a major
   (A) definitely (B) probably
   (C) probably not (D) definitely not
   12 4A

13. Do you feel that the Sound-on-Slide units you have been given fit the conditions and materials in your own shop? (answer yes or no)
   13 4Y
   If you answered "no" to #13, please explain your answer in more detail on the back of this page.

14. Do the techniques shown in the Sound-on-Slide units agree with what you would consider a proper way to do the jobs shown?
   (A) almost always (B) usually
   (C) sometimes (D) seldom
   14 1A 2B 1C

15. Have you noticed any deficiencies in the physical quality of the slide units themselves? That is, any deficiencies in the quality of the photography, camera angles, sound tracks, etc. that impede student use of the units? (answer yes or no)
   15 4N
   If you answered "yes" to #15, please describe the deficiencies that you have noted on the back of this page.

16. Which of the following best describes your students' reaction to using the Sound-on-Slide method in class?
   (A) very enthusiastic (B) enthusiastic
   (C) somewhat reluctant (D) very reluctant
   16 3B 1C

17. What impact on classroom management has the introduction of the Sound-on-Slide method had in your classes?
   (A) it has made classroom management easier
   (B) there has been no change in classroom management problems
   (C) it has made classroom management more difficult
   17 3A 1B

18. Are your students able to successfully complete the units that they are given?
   (A) always (B) very often
   (C) not very often (D) almost never
   18 4B

19. Do you feel a need for more staff development than you received in order to be able to use the Sound-on-Slide method successfully? (answer yes or no; if you answer "yes," an explanation on the back of this page would be appreciated.)
   19 4N

20. How important do you think it is that the equipment shown in a Sound-on-Slide unit exactly match the equipment in the shop where the unit is to be used?
    (A) extremely important (B) important
    (C) not very important (D) not important at all

20 2B 1C

21. Would you be willing to write Sound-on-Slide units specifically for use in your own shop? (answer yes or no; feel free to expand on your answer, if you wish)

21 3Y 1Y

22. Would you be willing to write Sound-on-Slide units for use in other teachers' shops? (yes or no)

22 2N

23. Since the main purpose of this questionnaire is to determine your reactions to the Sound-on-Slide units, we would appreicate any comments you may have that will either serve to explain some of your responses to these questions or to clarify your feelings about the units. Please indicate on the back of this page anything that you feel is important, especially those things that you think were not dealt with adequately in the preceding questions.

Appendix K

Questionnaire Responses of Teachers

at the Skills Centers

Responses from Teachers at Each Skills Center Are Listed Under Columns Headed "A" and "B"

1. For about what percentage of the subject matter that you teach have you been provided with 3M Sound-on-Slide units? — 1 See Table 4

2. Check those uses to which you have so far put 3M Sound-on-Slide units (check all that apply):

A	B		
25	15	a.	Initial instruction in an area, with individual students
18	12	b.	Review of previously taught material, with individual students
24	11	c.	Initial instruction in an area, with groups of students
17	8	d.	Review of previously taught material, with groups of students
15	11	e.	Helping absentees to "catch up"
20	9	f.	As a teaching aid while instructing the whole class at once
1	1	g.	Other (describe on back of page, please)
14	7	h.	Not used at all so far

NOTE: If you checked "h" in Item 2, omit questions 3 to 14 and answer only questions 15 to 22. If you did not check "h" in Item 2, please answer all of the following questions, from 3 to 22.

3. Give the letter of the choice in Item 2 that represents the main use to which you have put the 3M Sound-on-Slide units.

	A	B	
	14a	8a	
	4b	4b	
	5c	2c	
	1e	1d	
3	4f	3e	3f

4. During what percentave of class time would you estimate that the 3M Sound-on-Slide units are in use in your classes (in any way)?

4	Range = 1-100%	Range = 1-5-%	

5. How effective do you feel the units used in your classes are in teaching the material covered in them?

(A) very effective (B) effective
(C) ineffective (D) very ineffective

	6A		
	16B	7A	
	3C	6B	
5	1D	4C	

6. How effective have you found the units to be with Special Education students?

(A) very effective (B) effective
(C) ineffective (D) very ineffective
(E) not applicable--have not been used with such students

	3A	3A	
	12B	2B	
	1C		
6	11E	14E	

		A	B
7.	How enthusiastic are you about using the Sound-on-Slide units you have been given instead of the method you would ordinarily use to teach the same material? (A) very enthusiastic (B) enthusiastic (C) reluctant (D) very reluctant	7A 13B 6C	6A 7B 6C 1D
8.	Does it seem that your students are generally able to understand the material in the Sound-on-Slide units? (yes or no)	24Y 2N	17Y 0N
9.	Do your students generally seem willing to use these units without constant supervision and monitoring? (yes or no)	18Y 8N	11Y 6N
10.	How would you rate the ruggedness and reliability of the 3M Sound-on-Slide projectors, based on your personal experience with them in classroom use? (A) very rugged and reliable (B) fairly rugged and reliable (C) somewhat troublesome, requiring fairly frequent maintenance (D) very troublesome, requiring very frequent maintenance	2A 8B 12C 5D	2A 11B 4C
11.	How much involvement on your part is necessary in order for your students to be able to learn successfully from the Sound-on-Slide units? (A) a great deal (B) a moderate amount (C) very little (D) almost none at all	9A 18B	9A 5B 7C 1D
12.	How appropriate and useful have you found the Student Review and Evaluation Sheets (SRES's) that came with your units? (A) very appropriate and useful (B) somewhat appropirate and useful (C) somewhat inappropriate and not particularly useful (D) very inappropriate and generally useless (E) no such materials were provided with the units	4A 10B 5C 6E	2A 2B 14E
13.	Do you feel that the use of the Sound-on-Slide units has, for the most part, been beneficial to you and your students? (A) very beneficial (B) somewhat beneficial (C) not very beneficial (D) not beneficial at all	10A 13B 4C	7A 9B 2C 1D
14.	How useful do you feel the sound-on-Slide units you have been given have been in helping you teach your subject(s) this year? (A) very useful (B) moderately useful (C) not of much use (D) of almost no use at all	10A 11B 4C 1D	2A 10B 5C 2D

		A	B
15.	Have you had any difficulties in implementing the 3M Sound-on-Slide units in your classes? (Answer yes or no) If you answered "yes" to Item 15, please explain briefly on the back of this page what sort of difficulties you have had.	16Y 22N	9Y 13N
16.	Do you feel, based on your experience with the students you have met, that the use of Sound-on-Slide units is necessary in order for you to be able to successfully conduct your classes? (A) very necessary (B) somewhat necessary (C) not particularly necessary (D) not necessary at all	7A 15B 9C 9D	2A 5B 11C 6D
17.	Do you feel it is a good idea to use the Sound-on-Slide method of instruction as a major part of the curriculum in your subject area? (A) an excellent idea (B) a good idea (C) somewhat doubtful (D) probably not a good idea	12A 11B 10C 7D	6A 9B 4C 5D
18.	Do you feel that the Sound-on-Slide method is <u>best</u> used as an <u>aid</u> to conventional instruction, rather than as a major curriculum component? (A) definitely (B) probably (C) probably not (D) definitely not	23A 15B 1C	17A 6B 1C
19.	Do you feel a need for more staff development sessions, to learn to use the Sound-on-Slide materials more effectively? (answer yes or no)	16Y 23N	4Y 20N
20.	Do you feel a need for more time in which to develop materials (such as SRES's or slide units) to use with the PIVOT method? (yes or no)	25Y 7N	16Y 4N

21. If you have Sound-on-Slide units, but have <u>not</u> yet used them in any way, please check below any factors that explain why you have not yet used them.

A	B	
4	5	a. Student Review and Evaluation Sheets are not available
1	0	b. Have not had enough time to set up work stations.
2	2	c. No place in my shop to set up work stations.
5	7	d. Units supplied do not cover what I want to teach.
5	5	e. Content of units is outdated.

A	B		
6	7	f.	Equipment shown in slides does not match the equipment in my shop.
0	1	g.	Picture quality in slides is inadequate.
2	0	h.	Sound quality of recordings is inadequate.
4	4	i.	Other (specify):

22. Since the main purpose of this questionnaire is to determine your reactions to the Sound-on-Slide units, we would appreciate any additional comments that will serve either to explain your responses to these questions or to clarify other feelings you may have about the units. Feel free to mention anything that you feel is important, especially if you feel it was not dealt with adequately in the preceding questions.

Appendix L

Descriptions of the Settings in Which the Experiment was Conducted

Skills Centers

The Philadelphia skills centers are centralized, shared-time vocational education facilities offering training in a variety of vocational subjects to students enrolled in public or parochial high schools. Students are taught academic subjects at their home school and vocational subjects at the skills center. The skills centers feature individualized learning situations designed to prepare students for specific vocational career goals, and operate on an open entry-open exit system, with emphasis on individual student progress, rather than class progress. At the time of this study, two such skills centers were operating in Philadelphia.

Area Vocational-Technical Schools

The area vocational-technical schools in Philadelphia offer a combination of academic courses and intensive vocational and technical training. All vocational courses in such schools are state-approved vocational courses.

Comprehensive High Schools

These schools offer a combination of academic courses and state-approved vocational courses, including useful home economics and industrial arts courses. The vocational course offerings, however, are more limited than in the AVTS. Only students enrolled in state-approved trade and industrial and health education courses were involved in the present study.

Special Education Occupational Schools

These are schools exclusively for Special Education students for whom this setting has been determined to be the least restrictive environment. The schools offer a variety of vocational subjects, with related academic training.